Svaleryd, Helena; Vlachos, Jonas

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Financial Markets, the Pattern of Specialization and Comparative Advantage.
Evidence from OECD countries.[a]

Helena Svaleryd[*] and Jonas Vlachos[**]

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Abstract

Due to underlying technological differences, industries differ in their need for external finance. Since services provided by the financial sector are largely immobile across countries, the pattern of specialization should be influenced by the degree of financial development. We find this effect to be strong. In fact, the financial sector has an even greater impact on the pattern of specialization among OECD countries than differences in human- and physical capital endowment. Further, it gives rise to comparative advantage in a way consistent with the Hecksher-Ohlin-Vanek model. Results on which aspects of financial systems that are of importance for specialization are also presented.

JEL classification: F14; G20; O16

Keywords: Financial intermediation; Financial systems; Specialization patterns; Comparative advantage

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[*] Department of Economics, Stockholm University. Email: hs@ne.su.se.

[**] *Corresponding author*. Department of Economics, Stockholm School of Economics, P.O. Box 6501, 11383 Stockholm, Sweden. Fax: +46-8-313207. Email: jonas.vlachos@hhs.se.

1. Introduction

In a modern economy, financial markets and financial intermediaries play an important role by mobilizing savings, allocating credit, and facilitating the hedging, pooling and pricing of risks.[1] That a well-functioning financial sector has strong, positive effects on a country's aggregate growth opportunities has been shown by, for example, Levine et al. (2000). Since the need for external financing through financial markets differs depending on in which type of activity firms are involved, it would be surprising if the growth effect was completely symmetric across sectors and firms. Resent research (Rajan and Zingales 1998, Demirgüc-Kunt and Maksimovic 1998, Beck and Levine 2001) has actually found evidence that firms and industries heavily dependent on external financing grow faster in countries with well-developed financial systems. Given these empirical results, it is only natural to expect trading and specialization patters to be influenced by the financial sector. This paper adds to earlier research, first by reporting that differences in financial development among OECD countries have an even greater impact on the pattern of specialization than differences in human or physical capital. Second, we find that well-developed financial intermediaries and markets have a positive effect on the content of external financing in net trade. In other words, the financial sector gives rise to comparative advantages in a way consistent with the Heckscher-Ohlin-Vanek (HOV) model.

When discussing financial development, it is important to keep in mind that the financial sector has developed along different lines in different countries. Consequently, there has been an intense debate on the relative merits of the different systems, traditionally divided into bank-based versus market-based systems. By using a variety of indicators of financial development, we attempt to assess the relative importance of different aspects of the financial system on specialization patterns and the strength of comparative advantage. Our findings indicate that large and active stock markets, and the degree of competition in the banking sector, have the strongest effect on both specialization patterns and the trade content of external financing. Further, there is support for the view that the quality of investor information and the legal protection of creditors affect the pattern of industry specialization, while the depth of the financial system is a source of comparative advantage.

An obvious prediction of the standard Heckscher-Ohlin-Vanek (HOV) model is that a country well endowed with institutions of relatively high quality should tend to specialize in the production of goods relatively intense in the use of services provided by these institutions. This study treats financial markets and intermediaries as factors in the production of goods and services. A necessary condition for a production factor to give rise to comparative advantage is that it is immobile across countries. If financial intermediation were internationally mobile, however, we would not expect the strong growth effect of domestic financial development that is found in the empirical growth literature. Moreover, Jayrathne and Strahan (1996) show that the services provided by the financial sector are indeed highly immobile geographically, even within the USA.

This paper belongs to the small empirical literature investigating the effects of institutions on trade. In Svaleryd and Vlachos (2001), we find an economically significant relation between the degree of financial development and aggregate openness to trade. Anderson and Marcouiller (1999) find corruption and imperfect contract enforcement to be important determinants of aggregate bilateral trading volumes. To our knowledge, the present paper is the first to analyze empirically how financial markets affect industry specialization patterns and international competitiveness.[2] More broadly speaking, this is the first paper documenting that the institutional features of a society can give rise to comparative advantage. It also contributes to the literature on financial market and growth by focusing on absolute levels of production rather than growth rates. Finally, we provide new, indirect evidence to the debate on the relative merits of different financial systems to generate capital.

The paper is organized as follows. In Section 2, we start by discussing different aspects of the financial sector. Section 3 describes our measures and data of financial

[1] The contribution of the financial sector to GDP is large. Demirgüc-Kunt and Levine (1996) present estimates varying from around 5% of GDP in the US to 9% in Japan during the years around 1990.
[2] After the completion of this paper, the independent work by Beck (2001) was released. Beck addresses the same questions, using basically the same methods. He does not, however, control for a wider range of production factors. Hence, he cannot relate the size of the effect of financial markets on the pattern of specialization to the effect of other factors.

intermediation and other variables. Sections 4 and 5 present the results for industry specialization and factor content of net trade, respectively, and Section 6 concludes.

2. The financial sector

2.1 The financial sector as an endowment

What do we mean by our claim that the financial sector effectively works as an internationally immobile factor endowment? The question is important since Wood (1994) has shown that the inclusion of internationally mobile production factors in studies of the factor content of trade can yield incorrect predictions. Especially, he argues that since capital mobility has (more or less) equalized real interest rates across countries, capital cannot be a source of comparative advantage. This line of reasoning abstracts from the well-known imperfections of financial markets arising from informational asymmetries and conflicting interests between creditors and debtors however (see, for example, Stiglitz and Weiss 1981).

These problems have given rise to financial intermediaries specializing in project evaluation and monitoring and information dissemination, thereby mitigating the negative effects of market imperfections. Two countries with the same real interest rate, but with financial sectors of differing quality, are thus, in practice, differently endowed with financial capital. Alternatively, the problem can be seen from the perspective of the firm or industry: Industries heavily involved in projects subject to especially strong informational problems stand to gain most from the development of financial intermediaries, even if this development does not affect market interest rates. There is a huge literature on the underlying causes of, and possible remedies to, these problems. The degree of project uncertainty (Huang and Xu 1999) and the share of investments in intangible assets (Myers and Majuf 1984) are just two of the factors that make financial intermediation more important. Hence, it should be clear that financial intermediaries do not just raise money for financing investments in physical capital. In fact, it is difficult to have a clear prior on the factor content of the investments made with financial capital, which makes us draw the conclusion that the financial sector is best viewed as a type of human or organizational capital, specialized in overcoming market distortions in financing.

But are not the services provided by the financial sector internationally tradable, thereby erasing this source of comparative advantage? Several results in the empirical growth literature suggest otherwise. In a recent study, Levine et al. (2000) demonstrate that the *domestic* level of financial development is an important determinant of its economic growth. Following La Porta et al. (1997, 1998), they also show that a country's legal origin and the legal environment have strong effects on the development of the financial sector. Wurgler (2000) shows that more capital is allocated to growing industries, and less to declining industries, in countries with well-developed financial systems compared to other countries. This improved allocation of capital can explain why Beck et al. (2000) find that the development of financial intermediaries has a positive effect on total factor productivity growth.

Several micro-oriented studies also present results indicating the non-tradable character of financial services. Demirgüc-Kunt and Maksimovic (1998) show that firms highly dependent on external finance, located in countries with efficient financial and legal systems, tend to grow faster than similar firms in other countries. In an influential study, Rajan and Zingales (1998) show that the same result applies at the industry level. Giannetti (2000) presents evidence that the ease with which firms investing in intangible assets obtain loans depends on the legal system and the level of financial development. More direct evidence is found in Jayaratne and Strahan (1996), who show that financial services are difficult to trade geographically even within a country. In those US states that experienced relaxation in bank branch restrictions, the quality of bank loans improved and per capita income grew compared to those without banking deregulation. Finally, by investigating companies' cross-listing decisions, Pagano et al. (2001) conclude that geography is still of importance for financing.

All these studies demonstrate that the use of financial capital that, admittedly, is internationally mobile, to a large extent depends on the immobile institutional features of a society, summarized in measures of financial development. The problems pointed out by Wood (1994) when including measures of internationally traded physical capital in HOV-studies, hence do not apply to the endowment of financial intermediaries. It is therefore reasonable to expect countries with well-functioning

financial markets to have a comparative advantage in the production of financial services, and to specialize in industries highly dependent on external financing.

2.2 Views of the financial system

Although the above discussion is quite straightforward, it is also abstract. In reality, the financial system is not an entity that develops linearly along a single dimension; rather, there are intrinsic differences between different systems. Naturally, there is also a huge literature on the pros and cons of these different systems. Traditionally, the debate has been focused on bank-based versus market-based financial systems. Recently, however, new perspectives based on the overall efficiency of the financial sector, and its legal environment, have widened the debate.

Hardly anyone doubts that banks play an important role in the modern economy, by specializing in monitoring and screening firms, and by building long-term relationships with firms. Thereby, banks mitigate the informational problems between borrowers and lenders and allow them to provide financing for firms. Competitive equity markets could, however, potentially perform exactly the same functions as by banks, although Stiglitz (1985) argues that information disseminates quickly on well-developed markets. Hence, the individual investor has small incentives to acquire information in the market-based system, whereas the long-term relationships characterizing bank-based systems may mitigate this problem. Schleifer and Vishny (1986) present a similar argument i.e. that the easy by which the individual owner can sell their shares on a well-developed market reduces the incentives to exercise corporate control. All in all, it may well be that banks are better at assessing and controlling firms and managers, and hence at and providing financing.

Several objections have been raised to this negative view of markets. First of all, a well-developed stock market aggregates information about both firms and markets in a way not possible for an individual bank. Even though information spreads fast, there are large and quick gains to be made from acquiring superior information, possibly making markets better informed than banks. Second, corporate control may be facilitated by stock markets through compensation schemes linked to stock market performance. Further, Hellwig (1991) argues that rent extraction by banks can reduce manager incentives for profitable investments due to their inside information. It is also

likely that banks that issue debt have an incentive to be biased against high-risk projects, which can explain why Allen and Gale (2000) find that riskier industries attract more external funding in market-based economies. Another explanation for this might be that a well functioning stock market also expands the possibilities for risk diversification, thereby making high-risk projects more attractive for the individual investor.

Another possibility expressed by, for example, Huybens and Smith (1999) is that markets and banks are complements rather than substitutes. Then, it is the efficiency of the financial sector as a whole that is of importance, not whether the system is primarily based on markets or banks. Finally, as La Porta et al. (2000) have stressed, the legal system is a key determinant of the workings of the financial system. Especially, the legal system protects creditors and minority shareholders against expropriation by majority shareholders and managers. Legal investor protection is therefore associated with effective corporate governance and hence, constitutes a better staring point for cross-country comparisons of financial systems than the bank versus market framework.

Thus, there are four main views of the financial sector: the market based and the bank based views, the view that it is the overall size and efficiency that is of importance, and the view that it is the legal protection of creditors and shareholders that is of importance. In the next section, the different measures employed in this study are presented and related to these views.

3. Measurement issues and data

3.1 Financial dependence

The basic premise of this paper is that there are intrinsic technological reasons why industries differ in their dependence on external financing, and that these differences persist across countries. In the empirical trade literature, such assumptions are quite standard regarding other production factors such as human and physical capital. It is even standard procedure to assume the inter-industry ranking of intensity in factor usage to be stable over time. Making this assumption for financial dependence might therefore be more empirically than conceptually difficult.

In an innovative paper, Rajan and Zingales (1998) tackle exactly the problem of how to measure industry differences in financial dependence.[3] This is achieved by noting that when financial markets work relatively without friction, the supply of external financing will be very elastic. Differences in the actual use of external financing in such an economy will hence mainly reflect differences in demand for this type of funding. By arguing that the U.S. financial markets are the most advanced in the world, Rajan and Zingales use data on the actual external financing pattern of U.S. firms to calculate their measure of financial dependence. More precisely, their measure is defined as capital expenditures minus cash flow from operations divided by capital expenditures. To smooth fluctuations, they use data on the firm's external financing and capital expenditure over a 10-year period. In order to prevent that excessive weight from being given to large firms, industry values for each of the industries in their study are calculated as medians rather than means. According to this indicator, drug and medicines (ISIC 3522) constitute the most financially dependent industry, while the tobacco industry (ISIC 314) is the least so.

3.2 Financial development

Ideally, a measure of how well developed the financial sector is should gauge how effectively financial intermediaries and markets manage to mobilize and allocate capital. Thus, the ideal measure of financial development should be related to the variety of intermediaries and markets available, the efficiency with which they evaluate and monitor firms, and the legal and regulatory framework assuring performance. Although there are no perfect measures available, the recently developed indicators in Beck et al. (1999) proxy for the different aspects of the financial system outlined in Section 2.2.

The first couple of proxies are related to the size and activity of the stock market, and are hence related to the market-based view of the financial system. We use the stock market capitalization to GDP ratio (MCAP) which equals the value of listed shares to GDP, as an indicator of the size of the stock market. Second, the total value of stock

[3] Beck and Levine (2001) basically employ the same methodology as Rajan and Zingales, when asking if a bank-based or a market-based financial system is most conductive to the growth of financially dependent industries.

market trade to GDP (STRADE) is used to proxy for the activity of the stock market. Both these indicators suffer from the potential problem of capturing the forward-looking expectations of the economic agents, however if, for example, high growth and hence, high profits are anticipated, both MCAP and STRADE will increase. Although this could result in severe problems when considering the effect of these variables on growth as in Levine and Zervos (1998), it is not a problem since we here study within country and across industry differences. Another potential problem is that none of these measures reflect the amount of financing actually obtained by firms.

A commonly used proxy for the degree of overall financial development is the liquid liabilities to GDP ratio (LLY). This proxy is usually employed as an indicator of financial depth and has the advantage of being available for a wide range of countries. It is not, however, a direct measure of the financial sector's capacity to generate funds and may be most appropriate when other indicators are not available. A more direct aggregate indicator of the activity of financial intermediaries is the amount of credit given in an economy. More precisely, we use the ratio of private credit by deposit money banks and other financial institutions (DC) to GDP to proxy for this. One virtue of this measure is that it isolates credit issued to the private sector from the private sector. These two indicators are used to investigate the argument that the overall size and efficiency of the financial system is what is of importance for generating capital.

Next, we include indicators of the efficiency and market structure of commercial banks. A potential measure of the efficiency with which commercial banks channel funds from savers to investors is the net interest margin, i.e. the accounting value of a bank's net interest revenue as share of its total assets (MARGIN). This indicator serves as a proxy for the wedge between the prices faced by the parties on either side of a loan transaction. We define (CONC) as the ratio of the three largest banks' assets to total banking sector assets, as an indicator of the market structure. A highly concentrated banking sector might be less competitive and hence less efficient than a competitive one.[4]

[4] As will be discussed later, competition in the banking sector can have both positive and negative effects for the generation of external financing to firms.

The next set of proxies is more related to regulatory efficiency and hence to the potential of raising funds, rather than the actual outcome. For this purpose, we (again) follow Rajan and Zingales and use the accounting standards for each country in 1990 (ACSTAN). International comparisons of accounting standards are made by the Center for International Financial Analysis and Research. This proxy is supposed to reflect the potential for obtaining financing by reducing information cost. Hence, it can be considered as an overall indicator of the quality of information available to investors. As a check for the consistency of this index, we also make use of the 1983 accounting standards (ACSTAN83).[5] Finally, we turn to indicators of the legal rights of creditors and minority shareholders. MINORITY is an index from zero to six of how well protected minority shareholders are. The higher is the value of this index, the better the legal protection against expropriation. CREDITOR is an index between zero and four, increasing in the legal rights of creditors relative to management and other stakeholders.

3.3 Data on other endowments and intensities

In order to measure the input requirements of human capital, we use the share of workers with post-secondary education in each industry, weighted by the relative size of the respective industry. The average number of years of secondary schooling in the population above 25 is used as a proxy for the national endowments of human capital.

Whether or not to include physical capital in the analysis is an open question. The answer is contingent on the mobility of physical capital; if it is a mobile resource, it should not be included. We choose to follow the convention and include physical capital, especially since we want to ensure that the indicators of financial dependence and endowments do not proxy for any other type of production factors. Physical capital intensities are calculated as the OECD-averaged capital formation to value added ratio, while the physical capital per workers measure capital endowments. [6] In order to capture the effect of natural resource endowments, the stock of agricultural- and forestland per worker is also employed. The intensity of the former is just a

[5] The correlation between ACSTAN and ACSTAN83 is 0.70. ACSTAN83 is not available for Mexico.
[6] There are alternative ways of measuring both human- and physical capital intensities and endowments. We have employed several (see appendix) as checks on the robustness of the results.

dummy for food production, whereas the latter is calculated using Swedish input-output data. For further details on all variables and sources, see the appendix.

3.4 Trade data

Production and trade data by three and four-digit ISIC industry codes for the OECD countries are obtained from the OECD/STAN database. Since we are forced to combine different data sources, our final data set includes data on 32 manufacturing industries in 20 countries. In other words, it must be kept in mind that trade in services and raw materials is not included in this study.

4. The pattern of specialization

We first approach the question of how different countries' factor endowments affect international trade by considering the pattern of industrial specialization. The hypothesis is that the international competitiveness of an industry in a certain country depends on the resource endowments of that country and the input requirements of the industry. Balassa pioneered this approach in a couple of influential papers (Balassa 1979, 1986).

One obvious candidate as an indicator of international competitiveness and industrial specialization is the ratio between production and consumption as suggested by Gustavsson et al (1999),

$$(4.1) \qquad r_{ij} = \frac{Q_{ij}}{C_{ij}} = \frac{C_{ij} + X_{ij} - M_{ij}}{C_{ij}} = 1 + \frac{X_{ij} - M_{ij}}{C_{ij}},$$

where Q_{ij} is production, C_{ij} is consumption, M_{ij} is imports, and X_{ij} exports of good i in country j. It should be clear that when r_{ij} is greater than one, country j is a net exporter of good i, whereas a value lower than one indicates that the country is a net importer. In the analysis, r_{ij} is regressed on a set of variables constructed by interacting the input requirements of each industry i with the country characteristics of each country j. The larger the value of r_{ij}, the more specialized is country j in industry i.

In order to pick up fixed industry and country effects, a set of industry and country dummies is added to the regression. We take the logarithm of r_{ij} to ensure that the

trade imbalances end up in the country fixed effects. To see this, consider the case of balanced trade. It must then be true that

$$(4.2) \quad \sum_i Q_{ij}^B = \sum_i C_{ij}^B .$$

For each country *j* there exists a parameter β_j such that

$$(4.3) \quad (1+\beta_j)\sum_i Q_{ij} = \sum_i C_{ij} .$$

By scaling each element in the production vector by $(1+\beta_j)$, a hypothetical value of production under balanced trade is derived. The relationship between the measure of specialization under balanced and unbalanced trade can then be expressed as

$$(4.4) \quad r_{ij}^B = (1+\beta_j)Q_{ij} / C_{ij} = (1+\beta_j)r_{ij} .$$

By taking the logarithms of (4.4), it should be clear that the country-fixed effects capture the trade imbalance parameter $(1+\beta_j)$.

An alternative measure of industry specialization would be the one used by Balassa (1986), namely

$$(4.5) \quad (X_{ij} - M_{ij})/(X_{ij} + M_{ij}).$$

The main difference between this measure and r_{ij} is that it can take on a negative value. Thus, it cannot be adjusted for trade imbalances by taking on logarithms.

Although the approach behind (4.1) and (4.5) is inspired by the HOV-theory, it should not be considered as a formal test of the HOV-theory. Leamer and Levinsohn (1995) raise theoretical objections to this type of studies when the number of goods is larger than the number of production factors. Bowen and Sveikauskas (1992) demonstrate, however, that these theoretical objections are of little practical importance in actual empirical analysis. The patterns of industry specialization are shown to be consistent

with the net exports of factor services, especially for broad aggregates of production factors. What is important, though, is to adjust the dependent variable for trade imbalances. For this reason, we will mainly focus on r_{ij}, and keep the Balassa-measure for testing the robustness of the results.[7]

4.1 Estimation and Data

In order to estimate the impact of financial development on the pattern of industry specialization, we use data on industry factor input requirements and country-factor endowments. The expected sign of the interaction variables is usually positive, which means that a country well endowed with a certain factor will specialize in the industries with large input requirements of that factor. Exceptions are when net interest margin and bank industry concentration are used as proxies of efficiency and competition in the banking sector. Since higher values of these variables imply lower efficiency and competition, we expect the interaction between financial dependence and MARGIN and CONC to be negative.

This means that we estimate the following relationship:

$$(4.6) \quad \ln r_{ij} = \sum_{i=1}^{c} \beta_{1i} D_i + \sum_{j=1}^{n} \beta_{2j} D_j + \sum_{k=1}^{m} \beta_{3k} (\alpha_{ik} \times END_{jk}) + \varepsilon_{ij},$$

where i is the industry index, j is the country index, k is the factor index, D_i is a dummy for industry i, D_j is a dummy for country j, α_{ik} is the input requirement of factor k in sector i, END_{jk} is the endowment of factor k in country j, and ε_{ij} is the error term.

4.2 Results

Table 1 shows the results from the estimation of (4.6). Seven of the ten interactions between financial dependence and financial development are statistically significant and all have the expected signs. Further, all other interaction variables are positive as expected, but the interaction of agricultural inputs is not significant. Given the highly regulated agricultural sector in most OECD-countries, it might not be surprising that natural advantage is not a key determinant of the pattern of agricultural production.

[7] The correlation between the two indicators of specialization is 0.69.

Establishing statistical significance is a first step, but is the effect of financial markets on the pattern of specialization of economic significance? In column one, we see that the coefficient on the interaction term between financial dependence and the market capitalization ratio takes the value of 0.194. In order to interpret the economic magnitude of this coefficient, the following experiment is helpful: Consider that the industry at the 75th percentile of financial dependence was located in the country at the 75th percentile of financial development, rather that in the country at the 25th percentile of financial development. Further, consider the same switch of locations for the industry at the 25th percentile of financial development. How much larger would the industry of high dependence be in the high development country compared to the low-dependence industry, given that all other variables take on their average values?[8] In specification (1), this exercise leads to an increase in $\ln(r_{ij})$ by 0.103. For all industries, the average value of $\ln(r_{ij})$ is –0.164. Hence, the switch of countries would lead to a 10.8 percent increase in r_{ij}, compared to the average value. For the other (statistically significant) proxies of financial development, the same number is 12.2, 5.4, 7.0, 6.1, 8.7, and 8.5 percent. In comparison, the same thought experiment with respect to human and physical capital gives an increase in r_{ij} by around 5 and 6 percent, respectively. The impact of the financial system on the pattern of specialization must thus be considered as very large.

When turning to the specific indicators of financial development, we see that both stock market indicators (MCAP, STRADE) are statistically significant. Moreover, the size-effect of these variables is the largest among all interaction terms. This shows that a well-developed stock market is the most important source of competitive advantage among financially dependent industries. In other words, we have indirect support for the view that a market-based financial system is the most efficient.

Neither of the aggregate indicators of financial-sector development, LLY and DC, seem to be of much importance for the pattern of specialization. The liquid liabilities ratio is not even close to statistical significance, while the credit ratio is weakly

[8] This thought experiment is from Rajan and Zingales (1998). Mathematically, this means the following calculation:
$\text{COEFF} \times \{\text{FINDEP}_{75} \times (\text{FINDEV}_{75} - \text{FINDEV}_{25}) - \text{FINDEP}_{25} \times (\text{FINDEV}_{75} - \text{FINDEV}_{25})\}$

significant. The effect of DC is also among the smallest (although still large compared to the effect of human- and physical capital). One way of interpreting this is that the aggregate size of the financial sector is of less importance for raising funds, at least among OECD-countries. Thus, we have indirect evidence suggesting that the type of financial system is of importance.

Turning to the efficiency of the banking sector, the net interest margin (MARGIN) does not affect the pattern of specialization. The concentration index (CONC), which proxies for the degree of competition in the banking sector is, however, of importance. The result for banking concentration is interesting since it indirectly suggests that financially dependent industries have better access to credit when the banking industry is competitive. This contradicts Petersen and Rajan (1995) who show that competition in the credit market can be detrimental to the formation of firm-creditor relationships. The reason is that when creditors cannot hold equity claims, and the market is competitive, the creditor is forced to break even every period. For high-risk projects, this implies a very high interest rate that can distort the firms' incentives. In a monopolistic market, on the other hand, the creditor can cross-subsidy the firm over time – to the mutual benefit of both creditor and lender.[9] Rather, the result in column 5 constitutes indirect support of the view put forward by Rajan (1992). There, he suggests banks with market power extract rents and hence, reduce the firms' incentives to invest.

Accounting standards (ACSTAN, ACSTAN83), the indicators of the aggregate quality of information available to investors, are also significant – both statistically and economically. Given the severe informational problems in the financial markets, it should not be a surprise that good information has a positive effect on the generation of external financing.

Finally, the results concerning the view that the legal protection of outsiders against expropriation attempts by insiders are mixed. Minority shareholder protection

[9] Petersen and Rajan (1995) also provide empirical evidence from the US, supporting this view. Using the same methodology as Rajan and Zingales (1998), Cetorelli and Gambera (2001) find that a concentrated banking sector supports the growth of financially dependent industries.

(MINORITY) does not seem to affect the pattern of specialization, while the protection of creditors (CREDITOR) does.

[Table 1 here]

4.3 Sensitivity analysis

There are many different ways of measuring most variables in of regression 4.6. Since we want to ensure that the results presented above are not due to our choice of indicators, we perform a number of sensitivity tests. Each cell of Table 2 refers to an individual regression, and shows the estimates of the interaction terms between financial dependence and financial development.

In row 1, we replace Ln(r_{ij}) with the Balassa (1986) measure of industry specialization: $(X_{ij} - M_{ij})/(X_{ij} + M_{ij})$. The results are remarkably consistent with the ones in Table 1. Accounting standards for 1990 lose their significance, as does the index of creditor rights. The indicators of financial depth and domestic credit, on the other hand, now gain statistical significance. Making the same analysis for the size of the effect as for ln(r_{ij}), we obtain an increase in the dependent variable by 0.075, 0.090, 0.031, 0.062, 0.063, 0.052, and 0.044 for each of the significant interaction terms. For human capital, the size-effect is around 0.06 and for physical capital 0.025. Thus, the large effect on the pattern of specialization previously found is not due to the choice of dependent variable.

In row 2, we instrument for financial development using each country's legal origin as instrument, as suggested by La Porta et al. (1998).[10] These instruments are a set of dummy variables taking the value one if a country is of British, Scandinavian, German, and French legal origin, respectively. To this set of instruments, we add the "rule of law" index produced by Business International Corporation. Although these instruments have successfully been used in other studies (e.g. Rajan and Zingales, 1998), we have some worries that there is too little variation in these variables since the analysis is limited to the OECD. However, the results from Table 1 are quite robust to the instrumentation, although the significance levels of the variables are

generally somewhat lower. One exception is that CREDITOR gains both in statistical significance and size: the point estimate increases from 0.07 to 0.25. If we were to take this estimate seriously, an increase in the creditor rights' index from 1 to 3 would imply an increase in r_{ij} by 23 percent.

In row 3, the human capital indicator is now replaced by an interaction term where the number of scientists per worker in each country is used as country endowment of human capital.[11] In this specification, all interactions between financial dependence and financial development except the one based on financial depth (LLY) are statistically significant. The point estimates are very similar to the ones in Table 1. If we calculate the size-effect for this indicator of human capital, we get a value of around 6 percent, roughly the same as when secondary schooling is used.[12]

In row 4, physical capital intensities are replaced by the British industry level capital stock to value added ratio, which is done to verify that the results are not contingent upon the flow-measure previously used. [13] The size-effect for this indicator is around 2 percent and hence, we can once again verify the results from Table 1.

In row 5, we exclude the US from the regression since the indicator of financial dependence is based on calculations on US firms.[14] This exclusion leaves the results unchanged.

Finally, we include interaction terms between industry intensity and country abundance of electricity and steel. Although these inputs are tradable, and hence should arguably be excluded from the regression, we include them to verify that the

[10] The evolution and persistence of the French and British legal traditions are discussed theoretically in Glaeser and Shleifer (2001).
[11] The correlation between SECSCH and SCIENW is 0.53.
[12] Hanushek and Kimko (2000) measure labor force quality by using international mathematics and science test scores. They can thereby avoid the unrealistic assumption that schooling is of equal quality in different countries. Moreover, the use of test scores reduces the likelihood of proxying for general development effects rather than human capital. Using their indicator (HCQ1) rather than quantity based indicators such as SECSCH and SCIENW does not alter the results in this paper. The size effect of HCQ1 is 4.8 percent (results available upon request).
[13] The correlation between CVAI and CAPVA is –0.07 (not significant). That the two measures are not correlated is of course naturally a matter of concern. CVAI, however, is highly correlated with electric intensity, sometimes used as a proxy for capital intensity. This leads us to put more trust in the measure.

results for financial development are not spurious (similar production factors are also included by e.g. Ellison and Glaeser 1999, and Gustavsson et al. 1999). Both new variables are positive and significant but, as can be seen, the basic results are, if anything, strengthened by their inclusion.

[Table 2 here]

5. The factor content of trade

A different approach to the question of how financial development affects the pattern of trade between countries is to consider at the factor content of net trade. Basically, this approach amounts to investigating if the financial system can be a source of comparative advantage. Traditionally, the sources of comparative advantages have been analyzed within the framework of the Heckscher-Ohlin-Vanek (HOV) model. If we consider of financial intermediaries as immobile factor endowments, the prediction of the HOV-model is that a country endowed with well-developed financial markets will be a net exporter of external finance.

5.1 Estimation and data

The way to derive an empirical measure of the factor content of net trade, somewhat consistent with the HOV-theory though relaxing the assumption of balanced trade, has been shown in for example Leamer and Levinsohn (1995). In the present paper, we modify the Leamer-Levinsohn measure in the same way as Lundberg and Wikner (1997). More precisely, we calculate the following measure

$$(5.1) \qquad Z_{jk} = \sum_i x_{ij} f_{ik} / \sum_i m_{ij} f_{ik} ,$$

where x_{ij} is the share of exports of sector *i* in country *j*, m_{ij} is the share of imports of sector *i* in country *j*, and f_{ik} is the input-requirement of factor *k* in sector *i*. Regardless of the trade balance, the ratio carries information about the relative factor content of

[14] It is by no means obvious why this should force us to exclude the US from the analysis. Rajan and Zingales do that in their paper, however, so we follow their example.

exports to imports. Specifically, if Z_{jk} >1 exports are more concentrated to k-intensive goods than imports (Lundberg and Wikner 1997).[15]

We use the Rajan and Zingales (1998) indicator of financial dependence as a proxy for the industry-requirements of external financing, as discussed previously (FINDEP). Likewise, we use the same indicators of financial development as before to proxy for the country endowment of financial intermediation. In this section, as well as before, we hope to be able to discriminate between what aspects of the financial system that are of importance for comparative advantage. This is done by studying at a whole series of indicators. All the measures are thoroughly described in Section 3.

The reason why we do not use exactly the same measure of factor content of net trade as suggested by Leamer and Levinsohn (1995) is that this would require data on world factor endowment of financial intermediation. The meaning of this is conceptually difficult to grasp. Rather than tackling these conceptual difficulties, we use the Z_{jk} of equation (5.1), which is very much in the spirit of the Leamer and Levinsohn measure.[16]

When constructing Z_{jk}, we have not taken the services of production factors in input goods into account. Thus, the net trade of external financing is calculated using only the direct and not the indirect input of services of financial markets.

5.2 Results

Japan has the largest net export of external financing according to definition (5.1). Other countries with high values in the Z_{fd} measure are Germany, Denmark and the U.K. At the bottom of the list, we find countries such as New Zealand, Australia and Greece.

[15]Equation (5.1) can thus be read as the factor content ratio under the restriction that balanced trade is achieved without a change in the composition of trade. The export (import) expansion needed to get rid of a trade deficit (surplus) is, in other words, assumed to be proportional across goods.

[16] The Leamer and Levinsohn measure, under the balanced trade restriction, would take the form: $\sigma_{jk} = \sum_i X_{ij}(\sum_i e_{ij} f_{ik} - \sum_i m_{ij} f_{ik})/V_{jk} = 1 - s_j / a_{jk}$, where X_{ij} is the export of good *i* from country *j*, V_{jk} is country *j*'s endowment of factor *k* and a_{jk} is country *j*'s share of world endowments of factor *k*.

When turning to regression analysis, indicators of human- and physical capital endowments, as well as the endowments of forest- and agricultural land, are included in the regressions. The reason is twofold. First, an industry's dependence on external financing may be a proxy for its human or physical capital intensity, for example, while a country's endowment of financial intermediation may be a proxy for its endowment in these production factors. To ensure that the results are not only an artifact of spurious correlation we control for the endowment of human and physical capital. Second, the exchange of external financing embodied in trade in services and raw material is not included, since the data covers manufacturing only. This may give a distorted picture of the factor content of trade for countries where raw material or services account for a large proportion of trade. Suppose that the external financing requirement in a sector not included in the data is very high (low). Then, the endowment figures will overstate (understate) the supply of external financing available for the manufacturing industry in countries where this particular sector is large. For this reason, it is necessary to include measures of the endowment of other production factors.

Table 3 presents results where the measure of factor content of net trade (Z_{fd}) is regressed on country endowment variables. There is definitely support for the hypothesis that the financial sector is a source of comparative advantage. The measures of stock market size (MCAP) and activity (STRADE) both positively enter the regression. The same is true for the proxy for the liquidity, or financial depth measure, of the financial sector (LLY), and the competition indicator of the banking sector (CONC). However, DC and the other proxy regarding the functioning of the bank sector (MARGIN) are not statistically significant. Moreover, there is no positive effect of a country's accounting standards or its legal framework on the net factor trade of external financing.

Thus, the effects of the endowment of financial intermediaries on a country's pattern of specialization and comparative advantage in trade are roughly the same. Notably, the size and activity of the stock market and the concentration of the banking system have a significant effect on both variables.

Admittedly, it is not easy to judge the economic effects of being endowed with well-developed financial intermediaries, since we deal with proxies of what we attempt to measure. To investigate the effect in the different proxies for financial intermediation, imagine an increase of, for example, STRADE by one standard deviation. This induces an increase in Z_{fd} by 23 percent from the mean. The impact of the other significant proxies is around 20 percent, or around 60 percent of one standard deviation. Another way of assessing the effect of the financial service endowment is to see what happens if it is excluded. Column 1 reveals that removing the proxy for financial intermediation reduces the adjusted R^2 from about 0.45 to 0.03. Thus, the statistically significant proxies have a remarkable effect on the fit of the regression.

[Table 3 here]

5.3 Sensitivity

As checks for robustness, we have replaced SECSCH with the test-based labor force quality indicator (HCQ1, results are not presented), but this has no effect on the results presented in Table 3. We also include other control variables in the regressions. First, it may be the case that the indicators of financial development capture some aspect of economic development not accounted for by the other endowment variables. We therefore include GDP per capita, but the results remain unchanged. Second, the public sector is likely to be financed in other ways than through the private financial markets. Thus, for a country with a large public sector, the true endowment of financial intermediation available for private manufacturing may be larger than in a country with smaller public employment. Including the share of public employment does not, however, affect the results.

Finally, we run all specifications in Table 3 on an alternative measure of factor content of net trade. This measure is constructed as the ratio of factor content in net trade, corrected for trade imbalance, to factor content in consumption. Specifically,

$$(5.2) \quad W_{jk} = \frac{\sum_i f_{ik}(X_{ij} - M_{ij} - B_j \frac{Q_{iw}}{GDP_w})}{\sum_i f_{ik} C_{ij}},$$

where f_{ik} is the input-requirement of factor k in sector i, X_{ij} the exports of sector i in country j, M_{ij} the imports of sector i in country j, B_j country j's the trade imbalance and C_{ij} country j's consumption of good i. Q_{iw}/GDP_w is the share of world output of good i in world GDP. Once more this has little effect on the results presented in Table 3. All results remain qualitatively the same, except in the specification including LLY, where LLY is no longer statistically significant on conventional levels.

So far, the results show strong support for the hypothesis that the financial system can give rise to comparative advantage. Specifically, countries endowed with large and active financial intermediaries are more likely to have a larger net export of the services provided by the financial sector. To obtain a greater understanding of the impact, we derive a similar measure for net trade of human capital. The purpose of this paper is neither to test the validity of the HOV-model, nor to study the effect of a country's human capital endowment on the trade pattern. Nevertheless, it may be enlightening to look at the equivalent measure of comparative advantage for human capital, mainly for two reasons. First, it might indicate whether the proxies used for human capital intensity and human capital endowment are valid. Second, it may make us more comfortable with our measure of net factor trade. Keep in mind, however, that the HOV-model has found limited support in the empirical trade literature.

A common procedure when studying the empirical support for the HOV-model is to conduct rank and sign tests (Leamer and Levinsohn 1995). According to the HOV-model, a country's ranking in net trade of a specific factor should correspond to its ranking in terms of endowment. We use the measure of net trade in factors as defined in equation 5.1. Table 4 shows the Kendall's rank test for the two production factors financial intermediation and human capital. We use the share of workers with post-secondary education, weighted by the relative size of that industry, as input requirements of human capital.

The results for the different proxies for financial intermediation are in line with the regression results presented in Table 3. All correlations, except for accounting standards, carry the expected sign and four are statistically significant. The correlations between our measure of the net trade of services of human capital and endowments of human capital are also positive (and significant in two cases out of three). In light of the fact that empirical research finds limited support for the HOV-model, we consider these results to be satisfactory.

[Table 4 here]

6. Conclusions

The main finding of this paper is that countries with well-functioning financial systems tend to specialize in industries highly dependent on external financing. Although this might not be surprising in itself, the size of the effect is. In fact, differences in financial systems are more important determinants of the pattern of specialization between OECD-countries than differences in human or physical capital. One plausible explanation for this phenomenon is that the differences in human- and physical capital within the OECD are fairly small. Hence, the relative size of the effect might be smaller in a wider selection of countries. Whether this is true is a question left for future research. We also show that the financial system gives rise to comparative advantage in way consistent with the Heckscher-Ohlin-Vanek model.

Another way of studying this paper is as a robustness test of the Rajan and Zingales (1998) result that financially dependent industries grow faster in countries with well-developed financial markets. However, we approach this question by studying levels rather than growth rates. Given that Rajan and Zingales find strong signs of conditional convergence among industries (initially large industries tend to grow slower than initially small industries), it is by no means obvious that their result should carry over from growth rates to levels.

Especially strong results are found for indicators of stock market size and activity, as well as for competition in the banking sector. The latter result thus gives support to

theories suggesting that banking concentration limit the amount of capital raised by firms (e.g. Rajan 1992).[17] The quality of a country's accounting standards and the legal protection given to creditors are also important determinants of the pattern of specialization. Financial depth and the aggregate amount of credit in an economy give rise to comparative advantage, but the results for the pattern of specialization for these indicators are mixed.

Since this is one of the first papers approaching the question at hand, we have aimed at simplicity and clarity in the empirical analysis. One extension of this study would be to allow for other amendments common in the empirical HOV-analysis. These amendments might be to allow for cross-country technological and demand differences as suggested by Trefler (1993), Davis and Weinstein (1996), and Harrigan (1997). Another interesting extension is to analyze the potential effects of the financial market on the choice of technology. Since financial markets are supposed (and shown) to solve information problems in the market place, they are likely to affect the choice of technology. Carlin and Mayer (1999) take a first step in this direction by showing that the financial system affects R&D. To get a better understanding of its effect on technology, we would also need a better grasp of why some industries are more dependent on external financing than others are. This might be a fruitful area for future research with implications for the literature on growth as well as international trade. Incorporating other institutional factors is another extension along these lines. As long as industries differ in their use of the services provided by these institutions (and the services are non-tradable), we would expect the pattern of specialization to be determined by institutional factors.[18]

Finally, there are at least two reasons for expecting the pattern in this paper to disappear over time. First, multinational corporations are supposedly insensitive to local financing conditions. To the extent that MNC:s continue to increase their share of international trade, local financial markets should exert a continuously smaller impact on the pattern of trade. The same applies if financial markets effectively

[17] The finding that banking sector concentration is conductive for the growth of financially dependent industries reported in Cetorelli and Gambera (2001) also hinges on conditional convergence.
[18] Naturally, measuring input requirements of institutional factors, and institutional quality is difficult. That wage-setting institutions compressing the wage distribution can affect the industrial composition is supported by evidence in Davis and Henrekson (2000).

become better integrated across countries over time.[19] Hence, extending the analysis along the time dimension might be fruitful.

[19] Petersen and Rajan (2001) document an increase in the physical distance between small firms and lenders in the US over time. This increase is correlated with higher bank productivity and hence, constitutes evidence that financial development reduces the need for proximity between borrowers and lenders.

Appendix

Table A1. Correlations and summary statistics: Endowments

	Mcap	Strade	Lly	Dc	Conc	Margin	Acstan	Acstan 83	Credi-tor	Mino-rity	Secsch	Scienw	HCQ1	Kapw1	Agrilw	Rwood w	Elecw	Steelw
Mcap	1																	
Strade	0.80***	1																
Lly	0.72***	0.68***	1															
Dc	0.74***	0.75***	0.72***	1														
Conc	-0.36*	-0.50**	-0.47**	-0.18	1													
Margin	-0.46**	-0.50**	-0.43**	-0.68***	-0.11	1												
Acstan	0.39*	0.16	0.00	0.43*	0.24	-0.37*	1											
Acstan83	0.48**	0.35	0.01	0.50**	-0.02	-0.49**	0.70***	1										
Creditor	0.27	0.33	0.20	0.20	0.03	-0.36	0.08	-0.01	1									
Minority	0.49**	0.36	0.31	0.51**	-0.06	-0.25	0.45**	0.29	0.16	1								
Secsch	0.15	0.38*	0.17	0.45**	-0.11	-0.46**	0.31	0.31	0.30	0.45**	1							
Scienw	0.62***	0.81***	0.38**	0.71***	-0.23	-0.66***	0.42*	0.67***	0.30	0.34	0.53***	1						
HCQ1	0.42*	0.53**	0.54***	0.47**	-0.19	-0.61***	0.03	0.05	0.61***	0.07	0.33	0.57***	1					
Kapw1	0.28	0.33	0.21	0.54**	-0.05	-0.68***	0.63***	0.56**	0.11	0.43*	0.63***	0.70***	0.34	1				
Agrilw	-0.02	-0.13	-0.12	-0.07	0.15	0.00	0.27	0.03	-0.39*	0.40*	0.11	-0.07	-0.45**	0.23	1			
Rwoodw	-0.15	-0.28	-0.20	0.07	0.49**	-0.24	0.50**	0.24	0-.16	0.28	0.27	0.00	-0.18	0.40*	0.20	1		
Elecw	0.01	-0.04	-0.17	0.20	0.38*	-0.26	0.59***	0.40*	-0.04	0.41*	0.37*	0.33	-0.06	0.63***	0.19	0.60***	1	
Steelw	-0.08	-0.12	-0.07	0.02	0.27	-0.30	0.25	0.12	-0.12	-0.09	-0.08	0.05	0.01	0.31	-0.03	0.59***	0.05	1
Mean	0.38	0.16	0.67	0.83	0.61	0.029	66	65	1.86	2.29	2.7	4.9	50,2	44.3	1.0	3752	18.7	1581
Stdev	0.27	0.15	0.30	0.42	0.23	0.013	10	11	1.06	1.42	1.1	2.4	5,8	12.5	1.4	4725	12.1	3292
75th perc.	0.48	0.21	0.75	1.09	0.46	0.018	74	73	3	4	3.1	6.5	54,2	53.0	-	-	-	-
25th perc.	0.15	0.04	0.50	0.49	0.87	0.044	61	61	1	1	1.9	2.7	44,6	39.9	-	-	-	-

*** indicates significance at the 1%-level, ** at the 5%-level, and * at the 10%-level. The last two rows display the values of the observations belonging to the 75th and the 25th percentile respectively.

Table A2. Correlations and summary statistics: Intensities

	Findep	Ahi	Cvai	Capva	Wood-int	Land-use	Elint1	Ironint
Findep	1							
Ahi	0.36**	1						
Cvai	0.14	0.10	1					
Capva	0.05	-0.13	-0.07	1				
Woodint	-0.06	-0.09	0.13	-0.11	1			
Landuse	-0.09	0.31*	-0.03	-0.13	-0.04	1		
Elint1	-0.19	-0.22	0.54***	-0.02	0.21	-0.05	1	
Ironint	-0.11	-0.06	0.20	-0.02	0.04	-0.03	0.14	1
Mean	0.34	0.07	0.15	0.41	1.7	0.03	185	0.03
Stdev	0.42	0.06	0.07	0.25	6.8	0.18	285	0.18
75th perc.	0.47	0.09	0.20	0.42	-	-	-	-
25th perc.	0.06	0.02	0.11	0.26	-	-	-	-

*** indicates significance at the 1%-level, ** at the 5%-level, and * at the 10%-level. The last two rows display the values of the observations belonging to the 75th and the 25th percentile respectively.

Table A3. Correlations and summary statistics: Dependent variables

	Mean	Stdev	Correlations	
Ln(r_{ij})	-0.164	0.482	1	-
Balassa	-0.210	0.431	0.69***	1
Z_{fd}	0.84	0.29	1	-
W_{fd}	-0.12	0.19	0.74***	1
Z_{hc}	0.98	0.52	-	-

*** indicates significance at the 1%-level, ** at the 5%-level, and * at the 10%-level.

Table A4. Industries and countries included

ISIC	*Sectors*	*Countries*
3110	Food	Australia
3130	Beverages	Austria
3140	Tobacco	Belgium
3210	Wearing Apparel	Canada
3220	Textiles, Apparel &	Denmark
3230	Leather & Products	Finland
3240	Footwear	France
3310	Wood Products	Germany
3320	Furnitures & Fixtures	Greece
3410	Paper & Products	Italy
3420	Printing & Publishing	Japan
3520	Other Chemicals	Mexico[1]
3522	Drugs & Medicines	Netherlands
3530	Petroleum Refineries	New Zealand
3540	Petroleum & Coal Pr	Norway
3550	Rubber Products	Portugal
3560	Plastic Products, n	Spain
3610	Pottery, China etc	Sweden
3620	Glass & Products	UK
3690	Non-Metallic Products	USA
3710	Iron & Steel	
3720	Non-Ferrous Metals	
3810	Metal Products	
3820	Non-Electrical Mach	
3825	Office & Computing	
3830	Electrical Machinery	
3832	Radio, TV & Communication	
3840	Transport Equipment	
3841	Shipbuilding & Repair	
3843	Motor Vehicles	
3850	Professional Goods	
3900	Other Manufacturing	

[1] Accounting standards from 1983 are missing for Mexico.

Data description

Dependent variables

$r_{ij} = Q_{ij}/C_{ij} = Q_{ij}/(Q_{ij} + M_{ij} - X_{ij})$, where Q_{ij} is the production, C_{ij} is the consumption, M_{ij} are the imports from the rest of the world, X_{ij} are the exports to the rest of the world, of industry *i* in country *j*. Average values 1989-91. Source: STAN. The definition is from Gustavsson et al. (1999).

Balassa = $(X_{ij} - M_{ij}) / (X_{ij} + M_{ij})$. Source: STAN.

$Z_{ik} = \sum_i x_{ij} f_{ik} / \sum_i m_{ij} f_{ik}$, where x_{ij} and m_{ij} are the shares of exports (imports) of sector *i* from (to) country *j*, and f_{ik} is the input requirement of factor k in sector i. The measure is called Z_{fd} when using external financing requirements and Z_{hc} when using human capital requirements. Source: x_{ij} and m_i are constructed from STAN average values in 1989-91, f_{ik} for external financing is FINDEP (Rajan and Zingales (1998)) and human capital intensity is AHI. The definition is from Lundberg and Wikner (1997).

$W_{jk} = \dfrac{\sum_i f_{ik}(X_{ij} - M_{ij} - B_j \dfrac{Q_{iw}}{GDP_w})}{\sum_i f_{ik} C_{ij}}$, where f_{ik} is the input-requirement of factor *k* in sector *i*, X_{ij} the exports of sector *i* in country *j*, M_{ij} the imports of sector *i* in country *j*, B_j is country *j*'s trade imbalance and C_{ij} country *j*'s consumption of good *i*. Q_{iw}/GDP_w is the share of world output of good *i* in world GDP. The measure is called W_{fd} when using external finance requirements. Source: X_{ij} , M_{ij} and C_{ij} from STAN average values 1989-91. f_{ik} for external finance is FINDEP. Q_{iw} the sum of production over the 22 countries included in the study and GDP_w is the sum of GDP for the countries in the study. B_j = total export-total import of goods and services for 1990 from World Development Indicators.

Financial variables

<u>External finance dependence:</u>

FINDEP. Capital expenditure minus cash flows from operations divided by capital expenditures. Data source: Rajan and Zingales (1998).

<u>Financial sector development:</u>

MCAP: Stock market capitalization to GDP, average 1989-91. Source: Beck et al (1999).

STRADE: Stock market total value traded to GDP, average 1989-91. Source: Beck et al (1999).

LLY: Liquid liabilities to GDP, average 1989-91. Source: Beck et al (1999).

DC: Private credit by deposit money banks and other financial institutions to GDP, average 1989-91. Source: Beck et al (1999).

CONC: Market share of the three largest banks. Source: Beck et al (1999).

MARGIN: Net interest margin to total assets. Source: Beck et al (1999).

ACSTAN: Accounting standards 1990. Source: Rajan and Zingales (1998).

ACSTAN83: Accounting standards 1983. Source: Rajan and Zingales (1998).

<u>Legal variables:</u>

MINORITY: Index of minority share holder rights, range 0-6. Source: La Porta et.al. (1998).

CREDITOR: Index of creditor rights. Range 0-4. Source: La Porta et.al. (1998).

RULELAW: *International Country Risk (ICR)* index of law and order tradition. Source: La Porta et.al. (1998).

SCAND, GERMAN, FRENCH, ENGL: Dummies of legal origin. Source: La Porta et.al. (1998).

Human capital

Human capital intensities:

POSTSEC: The share of post-secondary schooling in total employment, 1990, Swedish industries. Source: SCB Regional Labor Statistics, unpublished.

AHI: $\sum_j \{(EMPLOYMENT_{ij} / WORKERS_j) \times POSTSEC_i\} /$ *number of countries*. Source:

EMPLOYMENT from STAN average 1989-91, WORKERS from Penn World Tables 5.6.

Human capital endowment:

SECSCH: Average years of secondary schooling in the population over 25. Average 1985-90. Source: Barro and Lee (2000).

SCIENW: Number of scientists and engineers per worker. Year 1990 or the closest available (1988-93). Source: United Nations Statistical Yearbook.

HCQ1: Indicator of labor force quality, based on international mathematics and science test scores. Based on fixed world average test score. Source: Hanushek and Kimko (2000)

Physical capital

Physical capital intensities:

CVAI = $\sum_j capitalformation_{ij} / \sum_j value\ added_{ij}$ **,** Average 1989-91. Source: STAN.

CAPVA = Capital stock/ Value added in UK. Average 1993-95. Source: OECD Statistical Compendium, Industry, Science and Technology, Industrial Structure Statistics – Industrial Surveys.

Physical capital endowment:

KAPW1: KSTOCK/WORKERS. Capital per worker, thousands of dollars. Average 1988-90. Source: KSTOCK: Real net capital stock in millions of US dollars. This is the accumulated, depreciated, and deflated series (15 years, 13.33% depreciation rate) of gross fixed capital formation in each country. Investment deflators were taken from Summers and Heston. Average 1988-90. From the Factor endowments database, (FEDB) compiled by Maskus and Poterba.

Natural resources

Natural resource intensities:

LANDUSE: Agricultural land intensities: Dummy for food production (ISIC 311/2).

WOODINT: Definition: Millions of SEK worth of input of forestry products divided by millions of SEK worth of production (times 100). Source: SCB (1992).

IRONINT: Use of iron ore. Dummy for iron & steel production (ISIC 3710).

ELINT1: Definition: Total amount of purchased electrical energy in megawatt hours divided by total number of thousands of hours worked. Average value 1990/1991. Source: SCB Industristatistik.

Natural resources endowment:

FORLANDW: FORLAND/WORKERS. FORLAND: Area of forests and woodland measured in thousands of hectares. Source: The Production Yearbook of the FAO. Average 1988-90. FEDB.

RWOODW: RWOOD/WORKERS. RWOOD: Round wood production, cubic meters. Average 1989-91. Source: United Nations Statistical Yearbook.

AGRILW: AGRILAND/WORKERS. AGRILAND: Area of arable land and land under permanent crops or permanent pasture in thousands of hectares. Source: The Production Yearbook of the FAO. Average 1988-90. FEDB.

ELECW: ELEC/WORKERS. ELEC: Indigenous production of electricity (Gwh). Average 1989-91. Source: OECD Basic Energy Statistics, various issues.

STEELW: STEEL/WORKERS. STEEL: Crude steel and pig iron production in metric tons. Average 1989-91. Source: United Nations Statistical Yearbook.

General country factors

GDPPC: GDP per capita. Average 1988-90. Source: Penn World Tables 5.6.

GDPPW: GDP per worker. Average 1988-90. Source: Penn World Tables 5.6.

POP: Population in thousands. Average 1988-90. Source: Penn World Tables 5.6.

WORKERS: Workforce in thousands. Average 1988-90. Source: Own calculations GDPPC*POP/GDPPW.

GDP: Total GDP. Average 1988-90. Source: Own calculations GDPPC*POP.

TOTEXP: Total manufacturing export value in dollars. Average 1989-91. Source: STAN.

TOTIMP: Total manufacturing import value in dollars. Average 1989-91. Source: STAN.

GOVSH: Government share of employment. Defined as government employment/WORKERS. Average value 1989-91. Source: OECD Economic Outlook.

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Table 1. Dependent variable is Ln(r_{ij})

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
FINDEP×Ln(MCAP)	0.218***									
	(3.12)									
FINDEP×Ln(STRADE)		0.165***								
		(2.86)								
FINDEP× Ln(LLY)			-0.002							
			(-0.020)							
FINDEP×Ln(DC)				0.161*						
				(1.89)						
FINDEP×CONC					-0.407**					
					(-2.40)					
FINDEP×MARGIN						-5.592				
						(-1.46)				
FINDEP×ACSTAN							0.012***			
							(2.53)			
FINDEP×ACSTAN83								0.017***		
								(3.39)		
FINDEP×MINORITY									0.014	
									(0.51)	
FINDEP×CREDITOR										0.066**
										(2.00)
AHI×Ln(SECSCH)	1.505***	1.344***	1.782***	1.469***	1.744***	1.552***	1.494***	1.441***	1.729***	1.650***
	(3.15)	(2.73)	(3.82)	(2.93)	(3.76)	(3.13)	(3.17)	(2.50)	(3.69)	(3.54)
CVAI×Ln(KAPW1)	2.223***	2.241***	2.375***	2.231***	2.366***	2.266***	2.186***	3.319***	2.356***	2.350***
	(2.73)	(2.76)	(2.89)	(2.72)	(2.90)	(2.77)	(2.68)	(2.88)	(2.87)	(2.87)
LANDUSE×Ln(AGRIW)	0.024	0.022	0.031	0.026	0.027	0.026	0.035	0.027	0.032	0.024
	(0.44)	(0.40)	(0.53)	(0.46)	(0.50)	(0.45)	(0.61)	(0.47)	(0.55)	(0.42)
FOREST×Ln(RWOODW)	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
	(8.22)	(8.26)	(8.12)	(8.27)	(8.35)	(8.24)	(8.33)	(8.40)	(8.31)	(8.25)
% increase in r_{ij} [1]	10.8	12.2	-	5.4	7.0	-	6.1	8.7	-	8.5
ADJ R^2	0.300	0.300	0.281	0.289	0.290	0.286	0.295	0.330	0.282	0.285
# OBS.	619	619	619	619	619	619	619	587	619	619

Robust t-values in parenthesis. *** indicates significance at the 1%-level, ** at the 5%-level, and * at the 10%-level. Regressions include industry and country fixed effects. [1] The interpretation of this value is given in the text.

Table 2. Sensitivity analysis

	FD2 *MCAP*	*FD3* *STRADE*	*FD4* *LLY*	*FD5* *DC*	*FD7* *CONC*	*FD8* *MARGIN*	*FD1* *ACSTAN*	*FD6* *ACSTAN83*	*FD12* *MINORITY*	*FD13* *CREDITOR*
1) Balassa	0.159***	0.129***	0.184**	0.191***	-0.379**	-4.67*	0.005	0.009***	-0.004	0.036
	(2.73)	(2.82)	(1.90)	(3.13)	(-2.24)	(-1.82)	(1.48)	(3.23)	(-0.15)	(1.28)
2) IV	0.155	0.112*	0.278	0.283**	0.480	-9.780*	0.009*	0.019**	0.044	0.246***
	(1.24)	(1.67)	(1.43)	(1.94)	(1.46)	(-1.76)	(1.64)	(1.90)	(1.21)	(2.48)
3) Scientists per worker	0.209***	0.164***	-0.026	0.154*	-0.396**	-5.447*	0.012***	0.017***	0.014	0.067**
	(2.83)	(2.80)	(-0.33)	(1.73)	(-2.33)	(-1.38)	(2.47)	(3.12)	(0.51)	(2.00)
4) British capital intensities	0.224***	0.167***	-0.007	0.170**	-0.407**	-6.038*	0.012***	0.018***	0.016	0.067**
	(3.26)	(2.90)	(0.95)	(2.05)	(-2.41)	(-1.60)	(2.74)	(3.60)	(0.59)	(2.04)
5) US excluded	0.212***	0.162***	-0.014	0.146*	-0.391**	-5.919	0.011***	0.017***	-0.002	0.075**
	(2.97)	(2.67)	(-0.18)	(1.68)	(-2.12)	(-1.49)	(2.47)	(3.34)	(-0.05)	(2.16)
6) Electricity and steel added	0.235***	0.172***	0.014	0.194**	-0.370**	-7.119*	0.014***	0.019***	0.023	0.068**
	(3.36)	(2.97)	(0.19)	(2.27)	(-2.16)	(-1.85)	(3.04)	(3.64)	(0.82)	(2.07)

Robust t-values in parenthesis. *** indicates significance at the 1%-level, ** at the 5%-level, and * at the 10%-level. Each cell refers to an individual regression and shows the point estimate of the interaction between financial dependence and financial development. All regressions include indicators of human- and physical capital, agricultural- and forestland, as well as industry and country fixed effects. In row 1, the dependent variable is $(X_{ij} - M_{ij}) / (X_{ij} + M_{ij})$, in rows 2-6 it is $\ln(r_{ij})$. In row 2, we instrument indicators of financial development with the "rule of law"-index and dummies of legal origin. In row 3, the number of scientists per worker (SCIENW), rather than secondary schooling (SECSCH), is used to measure human capital endowments. In row 4, British capital intensities (CAPVA), than the capital formation to value added ratio (CVAI), are used to measure capital intensities. In row 5, the US is excluded from the regressions. In row 6, ELINT1×ln(ELECW) and IRONINT×ln(STEELW) are added to the regressions.

Table 3. Factor content of net trade (defined as in equation 5.1 Z_{fd}). Basic regressions.

	Z_{fd}	Z_{fd}	Z_{fd}	Z_{fd}	Z_{fd}	Z_{fd}	Z_{fd}	Z_{fd}	Z_{fd}	Z_{fd}
MCAP		0.620**								
		(2.59)								
STRADE			1.278***							
			(3.08)							
LLY				0.578***						
				(3.47)						
DC					0.352					
					(1.40)					
MARGIN						-4.091				
						(-0.57)				
CONC							-0.681**			
							(-2.22)			
ACSTAN								-0.859		
×1000								(-0.17)		
CREDITOR									-0.014	
									(-0.29)	
MINORITY										-0.002
										(-0.04)
KAPW1	0.005	-0.000	0.001	-0.000	-0.002	0.002	0.003	0.005	0.005	0.005
	(0.74)	(-0.02)	(0.27)	(-0.07)	(-0.39)	(0.36)	(0.75)	(0.62)	(0.72)	(0.75)
SECSCH	0.030	0.039	-0.023	0.034	0.013	0.028	0.015	0.029	0.035	0.031
	(0.73)	(1.05)	(-0.46)	(0.91)	(0.25)	(0.60)	(0.34)	(0.62)	(0.84)	(0.562)
FORLANDW	-12.032	-9.894	-2.735	-6.353	-5.719	-13.206	-0.346	-11.749	-12.313	-11.979
×1000	(-1.19)	(-1.18)	(-0.36)	(-0.96)	(-0.52)	(-1.13)	(-0.05)	(-1.20)	(-1.15)	(-1.17)
AGRILW	-0.050	-0.046	-0.054	-0.039	-0.043	-0.040	-0.065	-0.050	-0.053	-0.049
	(-1.20)	(-1.24)	(-1.63)	(-1.19)	(-1.13)	(-0.92)	(-1.53)	(-1.18)	(-1.41)	(-0.87)
Constant	0.667***	0.614***	0.751***	0.453*	0.695***	0.908*	1.185***	0.705***	0.684***	0.668***
	(4.58)	(4.37)	(6.72)	(1.88)	(4.86)	(2.14)	(5.53)	(3.70)	(4.80)	(4.45)
Adj R^2	0.037	0.448	0.467	0.463	0.221	-0.005	0.381	-0.031	-0.024	-0.032
N.obs	20	20	20	20	20	20	20	20	20	20

*** Indicate significance at 1%-level, ** at 5%-level, * at 10%-level. t-statistics based on robust standard errors in parentheses.

Table 4. Rank test between the factor content of net trade (Z_{jk} defined as in equation 5.1) and endowment

Production factor	*Proxy*	*Kendalls rank test*
Financial intermediation	STRADE	0.305*
	MCAP	0.221
	DC	0.286*
	LLY	0.324**
	CONC	-0.484***
	MARGIN	-0.074
	ACSTAN	-0.058
	MINORITY	-0.116
	CREDITOR	0.226
Human capital	SECSCH	0.238
	HCQ1	0.408***
	SCIENW	0.295*

*** Indicate significance at 1%-level, ** at 5%-level, * at 10%-level